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Development of Articulate Storyline 3-Based Digital Teaching Materials on the Subject of Atomic Structure and Periodic Elements System for SMA/MA Students in Class X

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The articulate storyline 3 application is a multimedia authoring tool used to create interactive learning media with content from a combination of text, images, graphics, sound, animation, and video that is usable on various devices such as laptops, tablets, and smartphones. Teaching materials developed based on articulate storyline 3 can help independent learning. The development model used as a reference in this study is the Borg and Gall model which consists of 5 stages: preliminary studies, design and development, design validation and revision, product trial, and final product dissemination. The results of the assessment of material and media experts on the level of validity of digital teaching materials have a very valid category with a percentage of validity throughout the whole at 87.95% and 93.3%, respectively. The student response to the digital teaching material during the trial was very positive, with an average overall percentage of 95.71% in small-group trials and 95% in large-group trials. Thus, digital teaching materials based on Articulate Storyline 3 on the subject matter of atomic structure and periodic systems of these elements are suitable for use in chemistry learning activities as a source of independent learning and learning media.

Graphical abstract
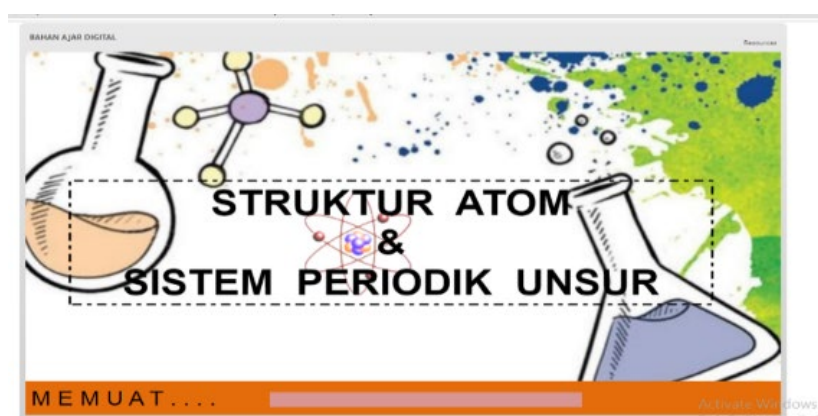
1. Introduction

Humans need education for the survival of their lives because education is a human effort to develop their potential through the learning process or in other ways that are known and recognized by society. Education is an activity to influence

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students in adjusting and behavior leads to more positive things and can cause a change in them [1].

Education in the current era is faced with the challenge of always adapting to developments and current conditions, especially with the Corona Virus pandemic or commonly known as Covid-19 which has killed off population mobility in Indonesia, one of which is learning activities in schools which have been diverted to independent learning. at home [2]. Overcoming conditions where learning activities experience obstacles, schools and especially teachers are required to be able to utilize computer technology to improve the quality of learning, and are also required to think creatively and also be able to become reliable creators to produce learning media that can keep students learning. and understand the material provided even though it is limited by pandemic conditions [3, 4].

Despite the outbreak of covid pandemic having now been over but the 2-year gap is enough to affect students who experience and are involved in the online learning process. So to erode these conditions, it is necessary to develop interactive media used as a method of adjustment for students. The online learning process generates demands for future technology involvement. Students will be able to adapt to the demands of the times increasingly able to adapt to the demands of the times, especially in starting of Revolution 5.0 or the metaverse era. Technology adaptation also needs to be carried out as a process to deal with the transition of the learning curriculum from the Curriculum 2013 to an Independent Learning Curriculum. Experience and learning atmosphere need to be improved so that students experience increased interest in understanding the material and continue to elevate the learning activity [5]. The media also functions to overcome the limitations of space, time, and the ability of the human senses as well as to create direct and indirect interactions between message sources, teachers, media, and students to help overcome various obstacles in the teaching and learning process such as from abstract material to non-abstract so that the communication process will work [6]. The selection of learning media must be adapted to the times, the characteristics of students, as well as the characteristics of the subject matter so that the learning process that occurs in the classroom takes place optimally because the appropriate selection produces a good effect.

As explained in the previous paragraph, Indonesia has met with digitalization. Therefore, opportunities to use technology to develop innovative learning media are urgently needed. The use of technology in the world of education has been seen in the emergence of applications to evolve various learning media [6]. One of them is Articulate Storyline 3 software, which is applied to create learning media with content in the form of text, images, graphics, sound, video, and even animation and simulation. Articulate Storyline 3 also has features similar to Microsoft PowerPoint [7]. This application is easy to learn for beginners who have the basics of making media using Microsoft PowerPoint.

One of them is Articulate Storyline 3 software, which is applied to create learning media with content in the form of text, images, graphics, sound, video, and even animation and simulation. Articulate Storyline 3 also has features similar to Microsoft PowerPoint. This application is easy to learn for beginners who have the basics of making media using Microsoft PowerPoint. However, this application is still very rarely used by teachers in creating learning media because teachers must have special abilities or skills to employ this application.

The Articulate Storyline 3 application is suitable for use in Chemistry courses because chemistry is a branch of natural science (IPA). Students' interest in Chemistry is generally low seen from the results of interviews with teachers and students at schools in East Sumba, namely SMA N 1 Waingapu, SMA N 1 Pahunga Lodu, SMA 1 Haharu, SMA Kristen Payeti, 67.7% average score -the average is 60-80 because the online learning process used is still ordinary. The teacher lacks creativity in developing learning materials through existing media and has not used digital teaching materials [8, 9]. The media used only text in WhatsApp groups and material from the internet. The problem of curriculum changes and lack of interest in learning chemistry among students can be prevented with software such as Articulate Storyline 3. Especially with the subject matter of atomic structure and the periodic system of elements, just studied in high school. In general, this material characteristic is abstract and requires deeper understanding from students to be more focused and active in participating in the learning process. Then the Articulate Storyline 3 application is helpful because it contains interesting features and can add text, images, graphics, sound, video, animation, and simulation [10]. The use of these applications creates media to help students interact and demonstrate subject matter. So students can understand the concepts explained through the learning media provided by the teacher.

The novelty in this research concerns the development of Articulate Storyline 3-based teaching materials on the subject of atomic structure and periodic systems of elements that have never been used before by teachers in East Sumba. The development of this teaching material can serve as the right solution to becoming an independent learning aid.

2. Material and Methods

1. Type of Research

The development of teaching materials based on Articulate Storyline 3, used research and development methods. This research method is used to produce products and test the effectiveness of these products [11]. This research used Borg & Gall models [12].

2. Data Type

The types of data obtained in this study are quantitative and qualitative data.

3. Data Collection Instruments

Data collection techniques are the application or application of instruments in the context of capturing or obtaining research focus data [13]. The equipment sources support the accuracy of the information in the production of chemistry learning media. Data collection techniques used in this study were expert validation sheets and student questionnaires.

4. Data Analysis Techniques

The type of data collected in this study is in the form of qualitative data converted into quantitative. The data analysis used in this research is descriptive.

3. Results and Discussion

In this study, the trial phase was arranged by material experts, media experts, and users or students by conducting limited trials with a total of 30 students divided into small groups and large groups. The following is the test results data.

1. Preliminary Study

At this stage, the researcher collects information related to the problems and needs of students in the learning process. The information is based on interviews with teachers and students at schools in East Sumba, namely SMA N 1 Waingapu, SMA N 1 Pahunga Lodu, SMA 1 Haharu, and SMA Kristen Payeti. The information shows that the online learning process is less attractive, the low creativity of teachers in developing digital-based learning media, the media used are only text in Whatsapp groups and material from the internet; This causes low interest in learning chemistry. So, we need software such as Articulate Storyline 3 to attract students' interest in chemistry lessons. This application is helpful because contains attractive features such as adding text, images, graphics, sound, video, animation, and simulation. This application is used to develop interesting digital teaching materials.

2. Product design

1) Start Page

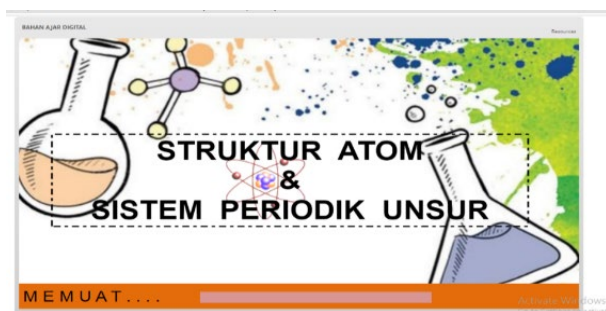The appearance of the initial page can be seen in the image below.

Image 1. Front Page

2) Cover Page

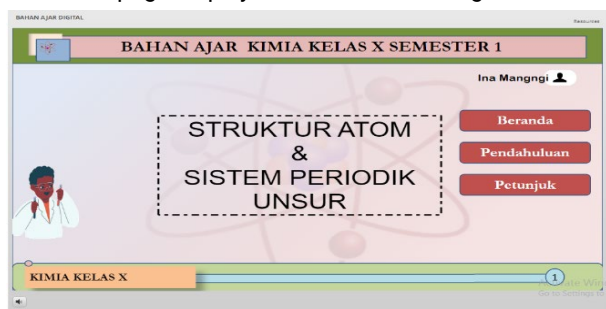The cover page display can be seen in the figure below.

Image 2. Cover Page

3) Introduction Page
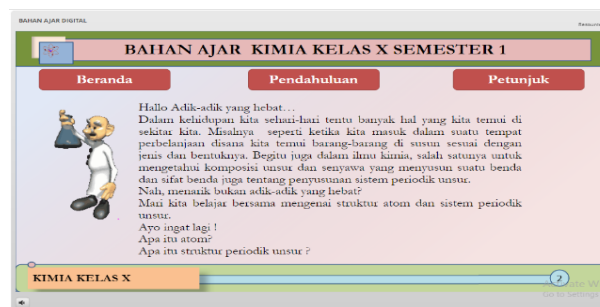
The introductory page display can be seen in the image 3.

Image 3. Introduction Page

4) Instructions for Use page

The user manual page display can be seen below.

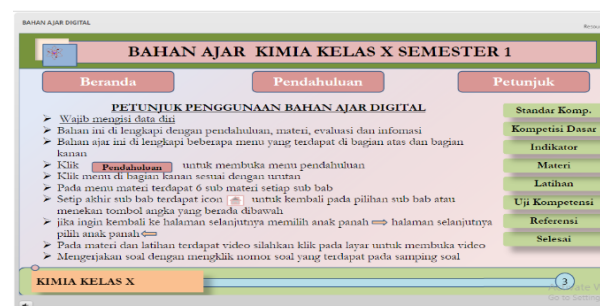**Image 4**. Instructions for Use page

5) Information Page

The display of the information page can be seen in the figure below.

Image 5. Information Page

6) Material Page

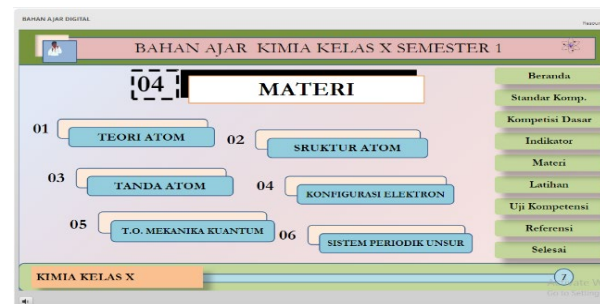The appearance of each sub-material page can be seen in the figure below.

Image 6. Material Page

7) Sample Question Page

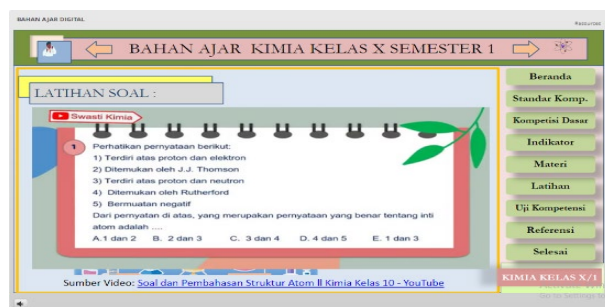The sample question page display can be seen in the image below.

Image 7. Sample Question Page

8) Competency Test Page

The display can be seen in the image 8.

Image 8. Competency Test Page

Articulate storyline software can involve other presentation software [12]. Presentation software involved in the design of this product includes audio, video, and PowerPoint.

3. Design Validation and Design Revision

1) Material Expert Validation

The results of the complete material validation assessment from the material expert can be seen in the Table 1.

Table 1. Averages and ideal percentages for each indicator of the three aspects of assessment in material's validation (revised results).

Assessment aspects	Indicator	average	% ideal
Content eligibility	Suitability of the material with Core Competencies and Basic Competencies	48	87.3%
	Conformity of teaching materials with learning objectives		
	Learning objectives are easy to understand		
	Material accuracy		
	The significance of learning materials		
	Principles of ethnoscience		
Presentation aspect	Material presentation techniques	58	89.2%
	Presentation support		
	Feasibility and suitability of evaluation test questions and feedback		
Linguistic aspect	straightforward	30.33	86.6%
	Communicative (dialogical and interactive)		
	Suitability with the development of students		
	Total score	**136.33**	**87.95%**

The average result of material validation from 3 experts was 136.33 with an ideal percentage of 87.95%. The following details of the aspects from material validation: a) content eligibility aspect of 87.3%; b) presentation aspect of 89.2%; c) linguistic aspect of 86.6%. The results of the percentage calculation compared with the ideal criteria [9]. The percentage value of the three aspects above is more than 85.01% and has an ideal category. This product is feasible to use. Even though it is considered suitable for use, there are several suggestions and ideas by the validator for the perfection of this product.

2) Media Expert Validation

After revising the suggestions and ideas from the validators (material experts), the researcher re-validated the teaching materials to the validators (media experts). The average results and ideal percentages (revised results) for each material assessment indicator are in the Table 2.

The average of media validation in the graphical aspect of the revised results of the three experts was 60.67 with an ideal percentage of 93.3%. The results of the percentage calculation compared with the feasible criteria [14]. The percentage value above is more than 85.01% and has an ideal category. This product is suitable for use without revision by media experts.

Table 2. Averages and ideal percentages for each indicator from the graphical aspect of media's validation (revised results).

Assessment aspect	Indicator	Indicator Items	Average	% ideal
graphics	changeable	The cover and appearance of the contents of the material attract the attention of students	9.67	96.7%
		The cover and delivery of the contents of the material attract the attention of students		
	Illustration	Balanced title placement	9.67	96.7%
		Display animation is not complicated and continuous with each other		
	Color composition	Contrast background color	9.33	93.3%
		Use of font color		
	Selection of font type and size	The typeface used is easy to read and attractive	9	90%
		The font size used is easy to read		
	Image eligibility	Interesting use of images	9	90%
		Clear image captions		
	Instructional Material Users	Programs or teaching materials are easy to understand	4.67	93.3%
	Text readability	Text readability is clear and attractive	9	90%
		The entire text is presented in a systematic and concise manner		
	Total score		60.67	93.3%

4. Product Trials

a. Small Group Trial

validated product by media experts and subject matter experts tested on students in small groups. The results of assessing student responses in small group trials are presented in the table below.

Table 3. Averages and Perfection Percentages of Small Group Trials on Digital Teaching Materials Based on Articulate Storyline 3 on the Subject Material of Atomic Structure and Periodic System of Elements.

Assessment Aspects	Average	% ideal
Learning	2.8	93.3%
Content Material	3.9	97.5%
Total score	6.7	95.71%

The average results on small group trial rating by respondents is 6.7 with a percentage of 95.71%. The percentage of student responses compared with ideal criteria [14]. The percentage value above is more than 91%, has an ideal category, and is feasible for use.

b. Large Group Trial

The tested products from small-group students then continued to verify on large-group students. Data on the results of student assessment responses in the large-group tested are represented in the table below.

Table 4. Averages and Perfection Percentages of Large Group Trials on Digital Teaching Materials Based on Articulate Storyline 3 on the Subject Material of Atomic Structure and Periodic System of Elements.

Assessment Aspects	Average	% ideal
Learning	2.8	93.3%
Content Material	3.85	96.25%
Total score	**6.65**	**95%**

The average results on small group trial rating by respondents is 6.65 with a percentage of 95%. The percentage of student responses compared with ideal criteria [14]. The percentage value above is more than 91%, has an ideal category, and is feasible for use.

Based on students' responses (Small-Group and Large Group tested) learning materials are equipped with pictures (visual), audio, and video (audio) easier to understand and more attractive. Learning media using visuals is very important in learning activities. The advantages of visual learning media can make participants Students will have a stronger memory and make it easier to understand the material. Instructional Media Visuals can also increase students' interest so that they can relate content material with the real world. Meanwhile, audio-learning media can stimulate the auditory senses. Therefore, by using the combination of audio and visual media, the learning material presented becomes more effective and attractive [15].

5. Final Product Dissemination

The final stage is to disseminate this teaching material by distributing this teaching material to those who need it, both teachers and students in the learning process, and can make this teaching material an efficient means of learning media at school or home.

4. Conclusions

This research and development produce a product in the form of digital teaching materials based on Articulate Storyline 3 which contains materials, videos, animations, sample questions, practice questions, and competency tests related to atomic structure and periodic systems. The resulting digital teaching material product based on Articulate Storyline 3 is an application with a Chrome HTML Document file format measuring 11 kilobytes, which is named "Digital teaching materials". The level of validity of the developed Articulate Storyline 3-based digital teaching materials is very valid with a percentage of assessments from material experts and media experts respectively at 87.95% and 93.3% in the very valid category. Student responses to digital teaching materials based on Articulate Storyline 3 which was

developed obtained a percentage value of 95.71% for small group students and 95% for students in large groups with both very good assessment categories.

Author Contributions

Dewi Lestarani: Conceptualization, Methodology, Resources, Investigation, Writing - Original Draft, Review & Editing. Arvinda C. Lalang: Methodology, Format analysis, Validation, Visualization, Review & Editing. Ina Manggi: Investigation, Resources, Visualization, Formal analysis.

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